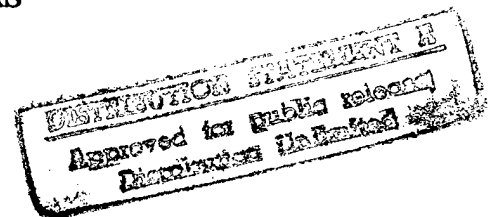


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FY 92 LIMITED ENERGY STUDIES  
FORT RUCKER, ALABAMA

CONTRACT NUMBER DACA01-92-C-0119

PREPARED FOR:  
MOBILE DISTRICT  
U.S. ARMY CORPS OF ENGINEERS  
MOBILE, ALABAMA



PREPARED BY:  
ENGINEERING RESOURCE GROUP, INC.  
P.O. BOX 360687  
BIRMINGHAM, ALABAMA 35236  
205/985-9090

~~JUNE~~  
MARCH 1993

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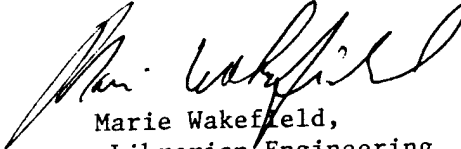


DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
P.O. BOX 9005  
CHAMPAIGN, ILLINOIS 61826-9005

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Marie Wakefield,  
Librarian Engineering

## 2.0 EXECUTIVE SUMMARY

In August of 1992, Engineering Resource Group, Inc., of Birmingham, Alabama was retained by the Mobile District U. S. Army Corps of Engineers to perform Limited Energy Studies at Fort Rucker, Alabama. These studies were limited to the evaluation of specific projects that have potential to reduce energy costs through energy demand control or conservation. These projects are:

1. LP Gas Storage: Evaluate the technical and economic feasibility of building and operating a liquified petroleum gas (LPG) storage facility at Fort Rucker to reduce natural gas demand charges.
2. Cooling Storage System For Peak Demand Reduction: Evaluate the technical and economic feasibility of reducing peak electrical demand at Lyster Army Community Hospital by the use of a cooling storage system.
3. Chiller Heat Recovery For Domestic Hot Water: Evaluate the technical and economic feasibility of recovering heat from the hospital chillers for preheating domestic hot water at Lyster Army Community Hospital.

Each project is summarized individually in the following discussions.

### LP Gas Storage

During the twelve month period from September 1991 to August 1992, Fort Rucker paid the Southeast Alabama Gas District a total of \$2,019,981.50 for the delivery of natural gas to the base. This natural gas was used to fire boilers in five central steam plants and to heat family housing. Of this total cost, \$491,647.22 or 24% was demand charges. The demand charges each month is established by the highest daily usage during a period of curtailment. On January 16, 1992, when the base was on curtailment, the daily usage was recorded at 3,436 MCF which set the basis for demand charges for the following eleven months. If this one day demand could have been reduced, it would have resulted in a lower delivered natural gas cost for the rest of the year.

One method of reducing this peak daily usage during a period of curtailment is to switch the dual fuel boilers in the central steam plants from natural gas to oil. The investigations conducted in this study indicated, however, that this was not done during the January 1992 period of curtailment. Assuming that there was good reason for not switching to oil during that period, this study examines the use of an appropriately sized LP Gas Peak Shaving plant as the only means of reducing demand during curtailment and evaluates the added benefit of switching from natural gas to oil in the central steam plants.

The economics of utilizing various sizes of LP Gas Peak Shaving plants are examined in this study. Considering good practice in the design and operation of such plants coupled with the added benefits of fuel switching in the central steam plants, a capacity of 1,500 MCF per day was selected for the proposed LP Gas Peak Shaving plant.

Annual Savings, MCF Demand	-	1,500
Annual Cost Savings	-	\$200,794
Total Investment	-	\$970,050
Simple Payback	-	4.83 Years
Total Net Discounted Savings	-	\$4,136,356
Savings To Investment Ratio (SIR)	-	4.26
Adjusted Internal Rate Of Return (AIRR)	-	12.00%

#### Cooling Storage System For Peak Demand Reduction

Lyster Army Community Hospital, Building 301 located at Fort Rucker, Alabama is a 72 bed total health care facility with a gross area of 206,720 square feet. It is presently cooled by a chilled water plant in the building utilizing three centrifugal chillers with a total capacity of 820 tons. These chillers are currently manually staged by operating personnel to meet building cooling loads.

A comprehensive Energy Engineering Analysis Program (EEAP) was performed at Lyster Army Community Hospital in 1989. The results of this program were available to facilitate the appropriate direction of the Limited Energy Studies evaluated under this contract. One of the Energy Conservation Opportunities (ECO 2) defined in the 1989 study has a significant impact on the ease of implementation of a Cooling Storage System. This ECO provides for the installation of primary-secondary chilled water loops with variable speed pumping in the secondary loop. Base personnel advised that this ECO has been selected for implementation and engineering has been done. The project implementation is now predicated on funding. This project to study a Cooling Storage System for Peak Demand Reduction has been developed assuming that ECO 2 from the 1989 study will be implemented.

An analysis of the 24 hour electrical load profile of the hospital during a peak summer day indicates a relatively level load. This, plus the fact that there are no specific incentives in the electric rate applicable to the base such as off peak demand cost reduction, would indicate that little potential existed for load shifting for demand reduction.

However, an examination of the same profile for the entire base reveals a significant swing from on peak loads to off peak loads. This swing on a peak summer day is as much as 15,000 KVA, more than enough to absorb the off peak use of the remaining unused capacity of the hospital chillers for storage. Utilizing Trane TRACE 24 hour cooling load profiles of the hospital, a strategy was developed to store adequate chilled water during off peak hours to meet the total cooling requirements of the hospital during the on peak six hour period the next day. This strategy results in a reduction of monthly demands at the base electric meter for 8 of the 12 months due to the 75% demand ratchet applicable to the peak summer month.

Annual Savings, KVA Demand	-	3,093.6
Annual Cost Savings	-	\$47,964
Total Investment	-	\$338,824
Simple Payback	-	7.06 Years
Total Net Discounted Savings	-	\$651,831
Savings To Investment Ratio (SIR)	-	1.92
Adjusted Internal Rate Of Return (AIRR)	-	7.45%

#### Chiller Heat Recovery For Domestic Hot Water

The Energy Engineering Analysis Program (EEAP) performed at Lyster Army Community Hospital in 1989 identified and recommended and ECO to utilize waste heat from one centrifugal chiller to preheat domestic hot water. This ECO is reevaluated in this study based on current implementation and energy costs. Additionally, an analysis has been performed of the impact of the selected chilled water storage strategy on this ECO.

Based on a review of the original estimate to implement the chiller heat recovery ECO, it was found that this estimated cost increased from \$21,870 to \$27,820. At the same time energy costs reduced from those used in the original ECO as follows:

Electrical Energy: From \$0.043993/KWH To \$0.0215/KWH

Natural Gas: From \$0.411/Therm To \$0.289/Therm

It was established that the methodology and estimates made of energy savings in the original ECO were reasonable and would be used in this reevaluation. The economics of the project change significantly as follows.

Annual Energy Savings:	
Electric	- 139.56 MBTU/Year
Natural Gas	- 963.60 MBTU/Year
Total	- 1,103.16 MBTU/Year
Annual Cost Savings:	
Electric	- \$879
Natural Gas	- \$2,785
Total	- \$3,664
Total Investment	- \$31,019
Simple Payback	- 8.47
Total Net Discounted Savings	- \$70,248
Savings To Investment Ratio (SIR)	- 2.26
Adjusted Internal Rate Of Return (AIRR)	- 8.00%

The revised economics for this ECO make its desirability for implementation questionable. It must be combined with other projects to be considered as an ECIP project.

As part of this ECO, further analysis was performed to determine the impact of the proposed cooling storage strategy on the heat recovery capability of the centrifugal chiller. Based on Trane TRACE projections of ton-hours produced by the chiller before and after, there was a projected reduction of chiller operating time of 36%. This reduction impacted the estimated energy savings and costs by the same amount. The resulting payback of the heat recovery ECO if combined with the cooling storage ECO is 11.85 years making this ECO not recommended if the cooling storage ECO is implemented.